The
OHIO STATE UNIVERSITY BULLETIN

VOLUME XLV FEBRUARY 7, 1941 NUMBER 9

THE FRANZ THEODORE STONE LABORATORY

FORTY-FIFTH SUMMER
1941-1942

PLANT TAXONOMY
PLANT ECOLOGY
ALGOLOGY
PLANT PHYSIOLOGY
HIGHER AQUATIC PLANTS
ADVANCED ENTOMOLOGY
AQUATIC ENTOMOLOGY
INVERTEBRATES
LIMNOLOGY
ADVANCED ORNITHOLOGY
HERPETOLOGY
COMPARATIVE PHYSIOLOGY
PHYSIOLOGY OF FISHES
FISH TAXONOMY
FISH ECOLOGY

THE OHIO STATE UNIVERSITY
COLUMBUS

UNIVERSITY CALENDAR

1941

SUMMER QUARTER

June 22	Dining Hall opens. Dormitory Assignments.
June 23	Registration, payment of fees, classes begin.
July 4	Independence Day. Classes. Picnic on Gibraltar.
July 26	First Term ends.
July 28	Second Term begins.
August 27, 28, 29	Final examinations.
August 29	Summer Quarter ends.

AUTUMN QUARTER

September 29	Latest day for registration and payment of fees without penalty.
December 20	Autumn Quarter ends.

1942

WINTER QUARTER

January 5	Latest day for registration and payment of fees without penalty.
March 21	Winter Quarter ends.

SPRING QUARTER

March 30	Latest day for registration and payment of fees without penalty.
June 15	Spring Quarter ends.

The Ohio State University Bulletin is issued twenty-four times during the year; once in October; twice each month in November and December; three times in January; four times each month in February, March, and April; three times in May; once in June.

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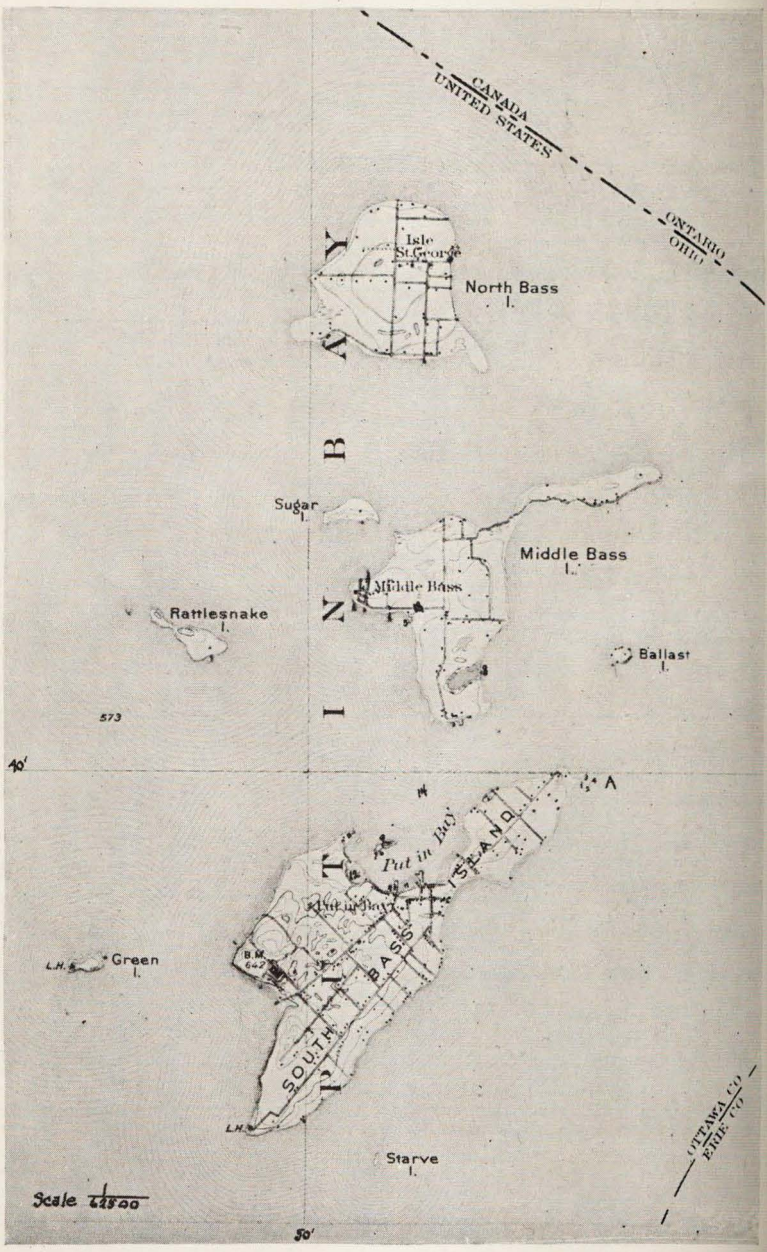

MAP OF THE ISLAND REGION OF LAKE ERIE, SHOWING LOCATION OF THE FRANZ THEODORE STONE LABORATORY

THE FRANKLIN CO. OHI.

CALENDAR FOR 1941

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THE FRANZ THEODORE STONE LABORATORY

OFFICERS

HOWARD LANDIS BEVIS, A.B., LL.B., S.J.D. ..... President
THOMAS H. LANGLOIS, Ph.D. ..... Director and Professor
PEARL CHANDLER, A.B. in Library Science ..... Librarian

ADVISORY COMMITTEE

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LAURENCE H. SNYDER ..... Professor of Zoology
EDGAR N. TRANSEAU ..... Professor of Botany
GUY WOOLARD CONREY ..... Professor of Agronomy
JORGEN M. BIRKELAND ..... Assistant Professor of Bacteriology
EDWARD MACK, JR. ..... Battelle Memorial Institute

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Assistant Professor

MILTON B. TRAUTMAN ..... Ichthyology
Research Associate

KENNETH DOAN, M.Sc. ..... Ichthyology
Research Assistant

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MARION W. BOESEL, Ph.D. ..... Entomology
Assistant Professor of Zoology, Miami University

EARL L. CORE, Ph.D. ..... Plant Taxonomy and Plant Ecology
Assistant Professor of Botany, West Virginia University

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Associate Professor of Zoology, Ohio Wesleyan University

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Professor of Zoology, University of Toronto

F. EARLE LYMAN, Ph.D. ..... Entomology
Assistant in teaching and research

BERNARD S. MEYER, Ph.D. ..... Plant Physiology and Higher Aquatic Plants
Professor of Botany, Ohio State University

ALVAH PETERSON, Ph.D. ..... Entomology
Professor of Zoology, Ohio State University

CLARENCE E. TAFT, Ph.D. ..... Fresh Water Algae
Assistant Professor of Botany, Ohio State University

THE OHIO STATE UNIVERSITY

The Ohio State University is situated within the corporate limits of the city of Columbus. It is supported by appropriations from the State and Federal governments. The University has almost 1,400 acres of land with nearly 400 acres in the campus. The total value of land, buildings, and equipment is $25,882,288.59.

ORGANIZATION

For convenience of administration the departments of the University are grouped into organizations called Colleges. The Ohio State University comprises ten Colleges and a Graduate School, each under the administration of a Dean and College Faculty, as follows:

Graduate School, College of Agriculture (including the School of Home Economics), College of Arts and Sciences (including the School of Journalism and the School of Optometry), College of Commerce and Administration (including the School of Social Administration), College of Dentistry, College of Education, College of Engineering (including the School of Mineral Industries), College of Law, College of Medicine (including the School of Nursing), College of Pharmacy, College of Veterinary Medicine.

THE UNIVERSITY YEAR—FOUR QUARTERS

The University year is divided into four Quarters, each approximately eleven weeks in length. The Summer Quarter is further divided into two terms of approximately six weeks each.

This *Bulletin* is devoted exclusively to the work offered at the Franz Theodore Stone Laboratory which is administered under the direct supervision of the President's office.

Shoreline of Pelee Island

THE FRANZ THEODORE STONE LABORATORY

The Franz Theodore Stone Laboratory is a separate department of the Ohio State University, with excellent facilities for researches throughout the year and for special summer course work in field and laboratory biology.

STAFF

The Laboratory maintains a full-time staff which is engaged principally upon researches during the Autumn, Winter, and Spring Quarters, and principally upon teaching during the Summer Quarter. This permanent staff is supplemented by a temporary staff during the Summer Quarter. Members of

1940 Staff. L. to R. Front: Taft, Core, Meyer, Chandler, Chandler, Langlois
Middle: Lyman, Boesel, Trautman, Senstius, Bangham
Rear: Beaver, Walker, Anderson, Hahnert

the summer staff are selected from the universities and colleges of the midwestern states. Many of them are heads of their departments, and all of them are outstanding in their respective fields.

LOCATION

The shallow western end of Lake Erie is marked off from the deeper waters to the east by a series of islands extending from Ohio to Ontario. Catawba Point juts out from the south shore between Port Clinton and Sandusky into the lake and the ferry Erie Isle makes the trip of six miles from Catawba Point to Put-in-Bay five times daily during the summer months. The three Bass Islands, South, Middle, and North, form part of the archipelago, and the town of Put-in-Bay, with a permanent population of about 400 people, is on the north shore of South Bass Island. Gibraltar Island is a limestone exposure, six

acres in area, deep-to on the north, with picturesque shoreline undermined in places by wave action, and sloping to the south where the Laboratory is located, facing the bay and the town of Put-in-Bay.

FACILITIES

The program for operation of the Franz Theodore Stone Laboratory involves the maintenance of excellent working conditions. The island is supplied with alternating current electricity carried to it by a submarine cable from South Bass Island. There are gas connections in the Laboratory, and sinks with running water in every laboratory and research room. Each research room

Class at Haunck's Pond. Middle Bass Island

is equipped with chairs, tables, table lamps, and shelves, and is large enough to hold from two to four workers. Stockrooms contain chemicals, chainomatic balance, water still, microscopes, glassware, and other necessary equipment. The limnology equipment, including reversing thermometers, water samplers, bottom dredges, screens, nets, etc., is stored adjacent to the Laboratory on the ground floor. Further equipment includes a sunshine intensity recorder, equipment for measuring light penetration into water, rain gauge, lake level recording gauge, anemometer, barograph, and thermograph. Trap nets and seines are operated by experienced fishermen to supply experimental material for laboratory workers, and there is an aquarium room with tanks, troughs, aquaria, aerators, etc. A diving helmet (Divinhood) is available for those who wish to see things from down under. There is a large equipped photographic darkroom, and two microprojection apparatuses built into special cases for the study of fish scales or other materials. A modern lantern slide projector is available for teachers and lecturers.

The library occupies the west end of the third floor of the Laboratory, with view of the lake on three sides. The Laboratory maintains a full-time librarian,

and the many books, serials, and separates are arranged for maximum availability. The library operates as a branch of the large University Library at Columbus, and special reference works are brought from the main library as needed.

The Laboratory owns a 35-foot launch, the Gibraltar, and a 30-foot launch, the Biolab, for the transportation of classes and research workers. There are eight row boats and two scows available, besides the raft anchored at the swimming beach. The Laboratory operates a Station Wagon, which is kept on the mainland at Catawba Point for transportation of people or equipment, and all field classes use this automobile for extending the scope of their activities along the south shore line.

LIVING ARRANGEMENTS

The Stone Laboratory supplies comfortable, congenial, and economical living conditions for those in attendance. Housing accommodations consist of a men's dormitory, a women's dormitory, and a community house for married people. All dormitories are well furnished and equipped with good beds. There is hot water, with baths, toilets, and laundry facilities available in each dormitory. Bedding, including an ample supply of good blankets, is furnished, and the men's and women's dormitories are supplied with maid service, but married people are expected to take good care of their own rooms. The men's dormitory has ten single rooms, six double rooms, and one triple room. The girl's dormitory has five double rooms and one triple room. The community house has seven double and three single rooms, and families with one or two children can arrange to have adjacent rooms. Privately owned cottages are also available.

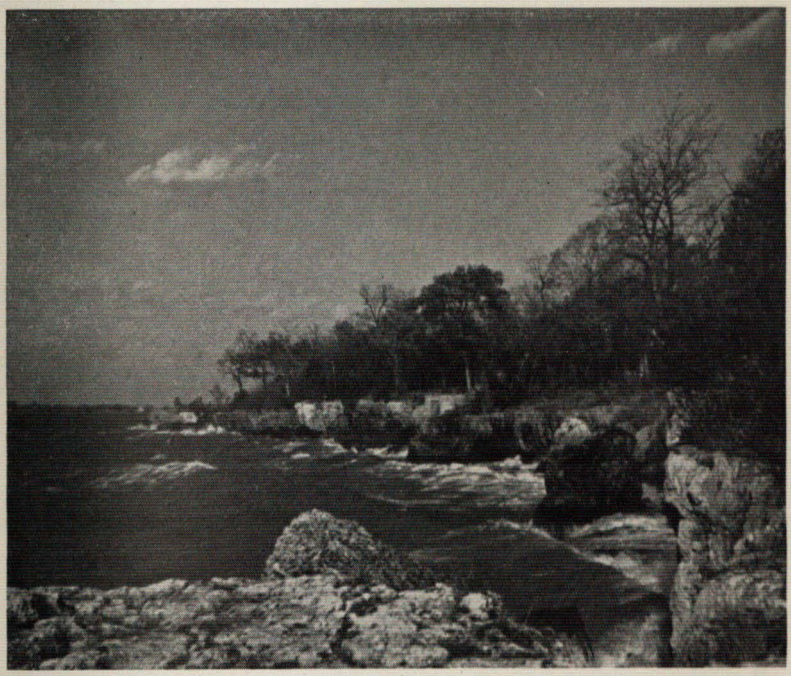
The dining hall is operated only during the summer session, and all persons in attendance may obtain their meals there.

No facilities are available for pets, and none should be brought along.

Laboratory class in action

RECREATION

In addition to the fun of field trips and boat rides, there is a swimming raft at the east end of Gibraltar Island where the water is clear and blue, there is volleyball equipment adjacent to the dining hall, and horseshoe courts back of the dormitories. The community house sits on a point with a large yard which contains swings and ladder for children of those in attendance. There are men's, women's, children's and tandem bicycles for rent in Put-in-Bay for those wishing to use them. The Bass Islands are well named, and those devotees



West Shore, South Bass Island

of the art of angling will find excellent fly casting for whitebass and bait or plug fishing for bass and rock bass.

There is a good piano in the dining hall and small instruments and music should be brought along for evening get-togethers.

FEES

Living costs and fees, including matriculation fee for new students for the eleven weeks, total about $150.

A matriculation fee of $15.00 is required upon registering as a student in The Ohio State University for the first time. The registration fee is $10.00 each term, or $20.00 for the entire Summer Quarter.

The payment of $60.00 for the first term and $55.50 for the second term for room and board must be made when registering for the first and second terms, respectively, by those who have arranged to live in the dormitories and eat in the dining hall. This is a flat rate of $1.00 a day for board, and fifty cents a night for lodging. Transient visitors will be supplied accommodations, if they are available, at the cost of $2.00 a day.

Although not specified as a fee, students enrolled in entomology will need $6.50 for insect boxes, books, and insect pins. Most of the courses require textbooks and notebooks, and a few incidentals, which may be purchased at the Laboratory.

Small charges will be made for all courses requiring special laboratory supplies and equipment.

RETURN OF FEES ON WITHDRAWAL

Fees are returnable in case a student withdraws on account of sickness or for other causes entirely beyond his control, if such withdrawal is made during the first thirty days of the Quarter. Students withdrawing under request from

Class collecting fishes

the University are not entitled to any return of fees. Permission to withdraw, given in writing by the Dean of the College, must be presented to the Bursar within this thirty-day period. Ordinarily, no more than one-half of the fees paid will be refunded; if the case has exceptional circumstances it should be referred to the President for his judgment.

No fees will be returned in case of withdrawal of students until thirty days have elapsed from the date of withdrawal.

If fees are paid under mistake of law or fact they are returnable in full.

Fees are not returnable except as provided in this rule.

Unused portions of dormitory and dining hall fees deposited at the beginning of the Summer Quarter will be refunded upon withdrawal from the Laboratory.

INDEPENDENT RESEARCH WORKERS

The research facilities and economical living conditions attract many workers to the Stone Laboratory every year, and such workers are especially welcome.

Qualified scientists who wish to carry on independent investigations at the Stone Laboratory during the Summer Quarter are provided laboratory space

and facilities for $3.50 a week and living accommodations at the same rate as others in attendance. Special equipment needed for such investigations should be brought along by the research workers.

The biota available to research workers and classes included various forms; characteristic types of land and water plant successions, and forms found on dunes, rocky shorelines, bays, marshes, and ponds.

REGULATIONS CONCERNING THE MASTER'S DEGREE

Scholastic Requirements. The general requirements for the Master's degree are: (1) the satisfactory completion of forty-five Quarter hours of acceptable work in a specialized field; (2) the presentation of a satisfactory thesis,

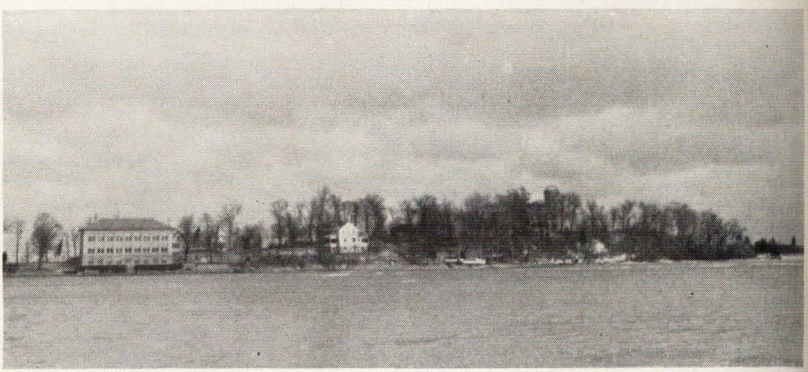
Exploring an island cave

credit for which will be included in the forty-five Quarter hours referred to above; and (3) the passing of a final comprehensive examination in the candidate's field of specialization.

Residence Requirement. Except under the conditions noted below a residence of three Quarters devoted wholly to graduate work is required for the Master's degree. For the benefit of students who cannot remain during the entire Summer Quarter, this Quarter is divided into two equal terms. A candidate for the Master's degree may complete his residence requirement by pursuing graduate work for four terms of different Summer Quarters, provided that in the *ad interim* periods between the summer terms, a satisfactory amount of work amounting to fifteen Quarter hours, is completed under the direction of a member of the instructional staff of the department in which the student is specializing.

Grade Requirements. A graduate student doing acceptable work for the Master's degree must obtain the mark "A" or "B" in not less than two-thirds of the work included in the course of study outlined for his degree, and not lower than "C" in the remaining one-third.

Time in which the work for the Master's Degree must be completed. The work for a Master's degree must be completed within a period of six years. In the case of students who take *all* the work for the Master's degree during the Summer Quarters, the above rule will be interpreted to include the seventh Summer Quarter.



Gibraltar Island

REGISTRATION INFORMATION

Registration for the Summer Quarter of 1941 will be held at the Laboratory on Monday, June 23. Investigators and students should submit applications for the Summer Quarter as early in the season as possible. Proper accommodations and facilities cannot be assured unless those who are planning to attend declare their intentions and arrange for their work by corresponding with the Director at Put-in-Bay before their arrival at the Laboratory.

Students from institutions other than The Ohio State University *must present a statement of credit courses from the Registrar or Dean of the institution they have last attended, to the Entrance Board of The Ohio State University at Columbus, Ohio.* This statement must be submitted at least two weeks before the opening of the Quarter to avoid delay in registration at the Laboratory. Those not desiring University credit need not present such credentials.

A maximum of eight hours credit (two four-hour courses) may be earned by students registering for the first term only, and an additional seven hours credit may be earned during the second term, or a total of fifteen credit hours may be earned during the entire Summer Quarter. Credits are transferable to other institutions under the usual regulations.

RECENT PUBLICATIONS RESULTING FROM STUDIES AT STONE LABORATORY

BANGHAM, RALPH V., and HUNTER, G. W. III. 1939. Studies on Fish Parasites of Lake Erie. Distribution Studies. Zoologica, N. Y. Zool. Soc. 24 (pt. 4); 385-448.

BATTLE, HELEN I., 1940. The Embryology and Larval Development of the Goldfish (Carassius auratus L.) from Lake Erie. Ohio Journ. Sci., 40; 82-93.

BOESEL, MARION W., 1938. The Food of Nine Species of Fish from the Western End of Lake Erie., Trans. Am. Fish. Soc., 67; 215-223.

BOESEL, MARION W., 1940. The Chironominae of Ohio with Special Reference to Those of the Put-in-Bay Region. Ohio State Univ., Abstr. Doctoral Dissert., 31; 17-23.

BROWN, C. J. D.; CLARK, CLARENCE; and GLEISSNER, BRUCE. 1938. The Size of Certain Naiades from Western Lake Erie in Relation to Shoal Exposure. Am. Midland Nat., 19: 682-701.

CHANDLER, DAVID C., 1940. Limnological Studies of Western Lake Erie. I Plankton and Certain Physical-Chemical Data of the Bass Island Region, from September, 1938 to November, 1939. Ohio Journ. Sci., 40: 291-336.

DENNIS, CLYDE AVERY, 1938. Aquatic Gastropods of the Bass Island Region of Lake Erie, Cont. No. 8 of the Franz Theodore Stone Laboratory, O. S. U.

DOAN, KENNETH H., 1940. Studies of the Smallmouth Bass. Journ. Wildlife Management. 4: 241-266.

KRECKER, FREDERICK H., 1939. A Comparative Study of the Animal Population of certain Submerged Aquatic Plants. Ecology, 20: 553-562.

LANGLOIS, T. H., 1939. Ohio Fish Management Progress Report. Ohio Conservation Bull. 3: 16-19.

MARSHALL, ANNE CORINNE. 1939. A Qualitative and Quantitative Study of the Trichoptera of Western Lake Erie (as indicated by light trap material). Annals Ento. Soc. Am., 32: 665-688.

MEYER, BERNARD S., 1939. The Daily Cycle of Apparent Photosynthesis in a Submerged Aquatic. Am. Journ. Bot., 26: 755-760.

POWERS, EDWIN B.; ROSTORFER, HOWARD H., and ROSTORFER, THERESA H., 1939. The pH, Carbon Dioxide Tension, and the Hemoglobin Percentages of Venous Blood of Various Fresh Water Fishes. Ohio Journ. Sci., 39: 1-9.

POWERS, EDWIN B.; ROSTORFER, HOWARD H.; SHIPE, LULA MAE; and ROSTORFER, THERESA HICKMAN. 1938. The Relation of Respiration of Fishes to Environment. XII. Carbon Dioxide Tension, as a Factor in Various Physiological Respiratory Responses in Certain Fresh Water Fishes. Journ. Tenn. Acad. Sci. 13: 220-245.

TAFT, CLARENCE E., 1940. Asexual and Sexual Reproduction in Platydorina caudata Kofoid. Trans. Am. Micros. Soc., Vol. LIX, No. 1, pp. 1-11.

TALBOT, MARY and KENNEDY, CLARENCE HAMILTON. 1940. The Slave-making Ant, Formica sanguinea subintegra Emery, its Raids, Nuptial Flights, and Nest Structure. Ann. Ento. Soc. Am., 33: 560-577.

TRAUTMAN, MILTON B., 1939. The Effects of Man-made Modifications on the Fish Fauna in Lost and Gordon Creeks, Ohio, between 1887-1938. Ohio Journ. Sci. 39: 175-288.

TRAUTMAN, MILTON B., 1939. The Numerical Status of Some Mammals Throughout Historic Time in the Vicinity of Buckeye Lake, Ohio. Ohio Journ. Sci. 39: 133-143.

WILLIAMS, J. FRED, 1940. The Sex Ratio in Nestling Eastern Red-wings. Wilson Bull., 52: 267-277.

COOPERATIVE PROJECTS

The Stone Laboratory invites cooperative projects for promoting programs of research and education. The cooperative agreement with the Ohio Division of Conservation makes possible the conduct of long term research projects, which aim directly to improve fishing in the waters of Ohio. Similar coöperative agreements with neighboring States or Federal agencies would prove mutually beneficial. Attacks on the problem of increasing the valuable fisheries of Lake Erie can only be effective when researches are sponsored by fishermen, as individuals, corporations, or organizations. Sportsmen's Clubs have been accumulating funds from sale of anglers' licenses, and wish to use these funds to improve local fishing. Four such organizations in Ohio, the Wooster Chapter

Field Class Picture

I.W.L.A., the Ashland Chapter I.W.L.A., the Central Ohio Hunters and Anglers Club, and the Hi-Buttles Club of Columbus, are now using their funds to sponsor fisheries research. The Wooster Club turns their funds over to Wooster College to subsidize studies of the fish populations of Wayne County streams by Dr. R. V. Bangham in cooperation with the Stone Laboratory, the Ashland Club turns its funds over to Ashland College for studies of the Ashland County waters, and the Columbus organizations use their funds to establish scholarships at the Stone Laboratory. More cooperative projects of this type are invited.

Cooperative projects with clubs of bird students to make possible studies of bird behavior and bird populations are invited.

Cooperation in the field of education with other institutions is an important part of the program of the Stone Laboratory. Most colleges and universities of the mid-western states offer many laboratory courses in biology, but few of them have summer stations where field biology can be presented. The staff

and facilities of the Stone Laboratory are available for such institutions, and their advanced students may here obtain the desirable well-rounded training in field biology.

The courses here announced for the Summer Quarter of 1941 were selected for the purpose of providing training in subjects which are not available to the students of most inland colleges, but which are important for research workers and teachers. All course work offered will be on the graduate level, but some courses may be taken by properly qualified upper classmen. Courses are offered only during the Summer Quarter, but students may register for research on special problems during any Quarter.

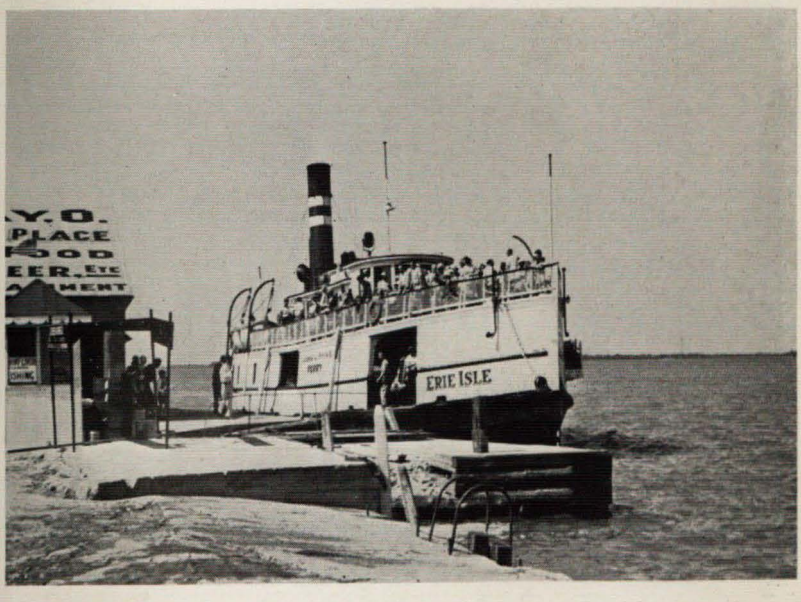
GENERAL INFORMATION

By automobile road the best approaches to the Catawba Point ferry landing are through Sandusky from points east and through Port Clinton from points west. From Sandusky, follow U.S. 2 westward across the Bay Bridge (toll 25¢ per car), to a road to the north marked by Put-in-Bay signboards. Follow this winding road through the orchards and vineyards to the boat landing, the distance being 17 miles from Sandusky to the dock. From Port Clinton follow U.S. 2 eastward two miles, then 163 for another mile, then the unmarked black top road along the lakeshore to the dock, a distance of nine miles from town to dock.

Automobiles may be brought to Put-in-Bay on the ferry Erie Isle and parked without charge in the Laboratory parking lot, beside the fish hatchery.

People coming to the Stone Laboratory by train should come to Sandusky on the New York Central Railroad. Two ferries leave Sandusky daily for Put-in-Bay, and upon arrival in Put-in-Bay a telephone call will bring the Laboratory launch for transportation to Gibraltar Island.

Excursion steamers from Detroit come to Put-in-Bay three or four times weekly. Ferry schedules will be sent upon request in advance of the opening of the summer session.



Erie Isle

Daily airplane service is maintained between Put-in-Bay and Port Clinton throughout the year, and provides the only way in and out when the boats cannot run.

MAIL AND BAGGAGE

All mail, packages, and trunks should be addressed in care of The Stone Laboratory, Put-in-Bay, Ohio.

In Sandusky, Millott's transfer agency on the Chippewa Dock is reliable and will give prompt attention to bringing trunks from the railway station to the steamer.

At Catawba Point, baggage may be placed directly aboard the ferry Erie Isle.

At Put-in-Bay, the launch from the Laboratory will meet passengers and transfer baggage when notified. Upon reaching the dock in Put-in-Bay, dial 341 for the Laboratory office.

DESIRABLE PERSONAL EQUIPMENT

The following suggested list of clothing and equipment will be useful during the summer:

Strong, comfortable shoes and clothing suitable for tramping or general field work (tennis shoes are a great convenience); sweater and other provisions for cool weather; raincoat; bathing suit; towels; flashlight; field, laboratory and lecture notebooks, although these can be obtained at the Laboratory; simple dissecting set; hand lens and canvas collecting bag for personal use (furnished for class use); strong knife; kodak; any textbooks, general or special, dealing with the subjects to be studied will be useful. Do not bring bedding.

COURSES OF INSTRUCTION

Registration may be made for the entire Quarter or for either term (six weeks each). A maximum of eight hours credit for the first term permits a student to register for two four-hour courses or problem courses and research may be carried during the entire Quarter. (The prerequisite course numbers refer to the University College Bulletins.)

BOTANY

663. Plant Taxonomy. Four credit hours. First term. Prerequisite, five Quarters of biological work and the consent of the instructor. Mr. Core.

The history of the development of the science of plant taxonomy. Field trips teach the use of keys for identification of plants in the local flora and illustrate the principles involved in classification of plants.

664. Plant Ecology. Four credit hours. Second term. Prerequisite, five Quarters of biological work and the consent of the instructor. Mr. Core.

Detailed field and laboratory studies of the many types of plant associations along the shores of Lake Erie, and the successions which have led to the occurrence of present forms.

665. Fresh Water Algae. Four credit hours. First term. Prerequisite, five Quarters of biological work and the consent of the instructor. Mr. Taft.

The course includes lecture, library, field, and laboratory work on the freshwater algae of the region, with particular emphasis on the phytoplankton. The aim of the course is to familiarize the student with the common forms of algae, experience in the use and making of keys, methods of collecting and preserving algae, and acquaintance with literature necessary to an appreciation of these plants.

669. Higher Aquatic Plants. Four credit hours. First term. Prerequisite, five Quarters of biological work, including a course in general botany. Mr. Meyer.

The biology of the aquatic plants of the Lake Erie region other than the algae. Field work on the identification and ecology of the more important species. Laboratory and field experiments on physiological processes as exemplified in aquatics. Also lectures, discussions, and collateral readings.

667. Physiology of Aquatic Plants. Four credit hours. Second term. Prerequisite, Botany 669, a course in plant physiology, or a course in general physiology. Mr. Meyer.

Qualified students may elect to work on one or more phases of the physiology of aquatic species. The work wil be largely on an experimental basis. Representative topics include measurements of photosynthesis and respiration, mineral salt nutrition, propagation of aquatic species, effects of various factors on growth and development, and the mechanism of the absorption of solutes.

701. Special Problems. Four to fifteen credit hours. Prerequisite, Botany 401-402 and one additional year of some biological subject, and the permission of the instructor in charge. Mr. Core, Mr. Taft, Mr. Meyer.

Properly qualified students may select some problem in taxonomy, ecology, or physiology of aquatic plants.

950. Research. Open only to properly qualified students. Mr. Core, Mr. Taft, Mr. Meyer.

Attention is also directed to Limnology which should be of interest to students of Botany.

ENTOMOLOGY

670. Advanced Entomology. Four credit hours. First term. Prerequisite, Entomology 550 or 450 or equivalent. Mr. Boesel.

This course is recommended to students who desire to prepare for professional work in entomology, to those who wish to study some special group of insects, and to those students of biology who wish to know the insect groups and their modes of life. Collecting, identification, and field work are stressed. Field trips are made to various islands and the mainland.

Not open to students who have credit for Entomology 651.

671. Aquatic Entomology. Three credit hours. Second term. Prerequisite, Entomology 670 or equivalent. Mr. Boesel.

This course deals with aquatic insects and is for students who desire preparation for work in teaching biology and for research on aquatic resources. Taxonomy and study of larvae are dealt with principally.

700. Special Problems. Three to fifteen credit hours. Prerequisite, Zoology 401-402 and Entomology 550 or 450 and 551 or equivalent and the consent of the professor in charge. Mr. Boesel.

Entomological subjects concerned with biological taxonomic, faunistic, morphological or economic problems may be selected.

950. Research in Entomology. General prerequisites must include Zoology 401-402 and Entomology 550 or 450 and 551 or equivalent. Mr. Boesel.

Graduate students who are properly qualified may undertake research problems in any phase of entomology.

GEOGRAPHY

***615. Climatology.** Three credit hours. Second term. Prerequisite, fifteen hours of biology, including one of the following courses: Geography 401, Geology 420, Botany 402, or Agronomy 501. Not open to juniors.

Elements of climate and their distribution. The controls of climate. Types of climate and their distribution with particular reference to agricultural production, natural vegetation and the major soil groups. Concluded by a consideration of the recent thought on the subject of climatic regions and their boundaries.

ZOOLOGY

621. Invertebrate Zoology. Four credit hours. First term. Prerequisite, twenty hours of biological science including Zoology 401-402 or equivalent. Mr. Hahnert.

Field and laboratory. The collection and identification of invertebrate animals, with the history of the development of methods of classification of invertebrates and emphasis upon the use of keys in identification.

622. Advanced Invertebrates. Three credit hours. Second term. Prerequisite, Zoology 621. Mr. Hahnert.

Field and laboratory. The study of the ecological relationships of invertebrate animals, with emphasis on fluctuations in abundance and food chains.

623. Fish Ecology and Management. Four credit hours. Second term. Prerequisite, Zoology 624 or equivalent and consent of the instructor. Mr. Harkness.

Lectures, field, and laboratory. Studies of the life histories and interspecific relationships of fishes, and of the various factors influencing their abundance.

624. Fish Taxonomy and Distributions. Four credit hours. First term. Prerequisite, Zoology 401-402 or equivalent, one additional year of biology, and consent of the instructor. Mr. Harkness.

Field and laboratory study of the distribution and classification of fishes, with emphasis on the use of phylogenetic and artificial characters of taxonomic importance. Methods of making collections and properly preserving them for study are taught.

* Not given in the Summer of 1941.

*631. **Animal Parasitology.** Four credit hours. First term. Prerequisite, Zoology 401-402 or equivalent.

This course deals with the animal parasites, with special emphasis on the forms infesting the vertebrates of fresh water. Lectures, student reports, field and laboratory work, including methods of examination of hosts, techniques for fixing, staining, and mounting specimens.

650. **Limnology.** Four credit hours. First term. Prerequisite, Zoology 401-402 or equivalent, fifteen additional hours in biology, ten Quarter-hours in chemistry and ten Quarter-hours in physics. Mr. Chandler.

Field and laboratory, studies of the physical, chemical and biological factors which determine biological productivity in Lake Erie and certain waters along the south shore of the lake. Field studies include plane-table mapping, the determination of dissolved gases and hydrogen-ion concentrations, depth of light penetration, as well as quantities of plankton and bottom fauna.

Not open to students who have credit for Zoology 614.

651. **Advanced Limnology.** Four credit hours. Second term. Prerequisite, Zoology 650 or equivalent and consent of the instructor. Mr. Chandler.

Field, laboratory, lecture and library work, involving studies of a specific aquatic habitat throughout the term, with each student presenting a report on the individual phase which he has studied. The class report will be a comprehensive treatment of the limnology of the region investigated.

*653. **Field Biology.** Three credit hours. Second term. A course in the study of field biology for advanced and graduate students. Prerequisite, fundamental courses in zoology and botany and permission of the instructor.

The work will include methods of collection and preparation of materials, types of habitat, associations of organisms, types of apparatus for field study, etc., and a problem will be assigned to each student as a part of the work.

655. **Advanced Ornithology.** Four credit hours. First term. Lectures, field trips, laboratory work and assigned readings. Prerequisite, Zoology 408 or its equivalent. Mr. Walker.

An advanced course dealing with the fundamental aspects of behavior of the individual bird and of bird populations under natural conditions. Topics of study include the role of instinct in the life of birds, the breeding cycle, social relations, territory, ecology and characteristics of populations. The field work will consist of practice in modern techniques of field study.

656. **Herpetology.** Four credit hours. First term. Lectures, field trips, laboratory work and assigned readings. Prerequisite, Zoology 401-402 or equivalent. Previous work in vertebrate zoology or comparative anatomy is desirable. Mr. Walker.

This course is designed to acquaint the student with local species of reptiles and amphibians, their habits, life histories, and ecology. Attention will be given also to principles of taxonomy and classification as illustrated by these groups.

659. **Comparative Physiology.** Four credit hours. First term. Prerequisite, Zoology 401-402 or equivalent, ten Quarter-hours in chemistry and ten Quarter-hours in physics. Mr. Anderson.

The physical and chemical principles necessary for the study of physiology will be considered in connection with studies of the nature of protoplasm, and activities of organisms with respect to their internal and external environment. Problems of nutrition of invertebrates will be emphasized.

660. **Physiology of Fishes.** Four credit hours. Second term. Prerequisite, Zoology 659 or equivalent and consent of the instructor. Mr. Anderson.

A special course intended for those who wish to have a detailed knowledge of the activities of fishes. The nutritive, circulatory, respiratory, sensory, and locomotor mechanism will be considered, both from the standpoint of structure and function, and in relation to the special problems which are encountered in fishes. As far as possible the laboratory work will be conducted to suit the interest of the individual student.

* Not given in the Summer of 1941.

700. Special Problems. Three to fifteen credit hours. All Quarters. Prerequisite, Zoology 401-402 and 625-626 or equivalent and the consent of the professor in charge. Mr. Langlois, Mr. Anderson, Mr. Chandler, Mr. Hahnert, Mr. Walker, Mr. Harkness.

Subject for investigation may be selected from one of the following: limnology, ichthyology, life history, development, morphology, taxonomy, or some other phase of zoology.

950. Research in Zoology. All Quarters. General prerequisites must include Zoology 401-402, 625-626 or equivalent. Mr. Langlois, Mr. Anderson, Mr. Chandler, Mr. Hahnert, Mr. Walker, Mr. Harkness.

Properly qualified graduate students who so desire may enter upon some faunal, ecological, or other problem under the direction of the instructor in charge of the subject chosen.

THE FRANZ THEODORE STONE LABORATORY 1941 COURSE SCHEDULE

FIRST TERM

Monday—Wednesday—Friday Courses

Botany 663—Plant Taxonomy
Zoology 650—Limnology
Zoology 655—Advanced Ornithology
Zoology 659—Comparative Physiology
Entomology 670—Advanced Entomology

Tuesday—Thursday—Saturday Courses

Botany 665—Fresh Water Algae
Botany 669—Higher Aquatic Plants
Zoology 621—Invertebrate Zoology
Zoology 624—Fish Taxonomy and Distributions
Zoology 656—Herpetology

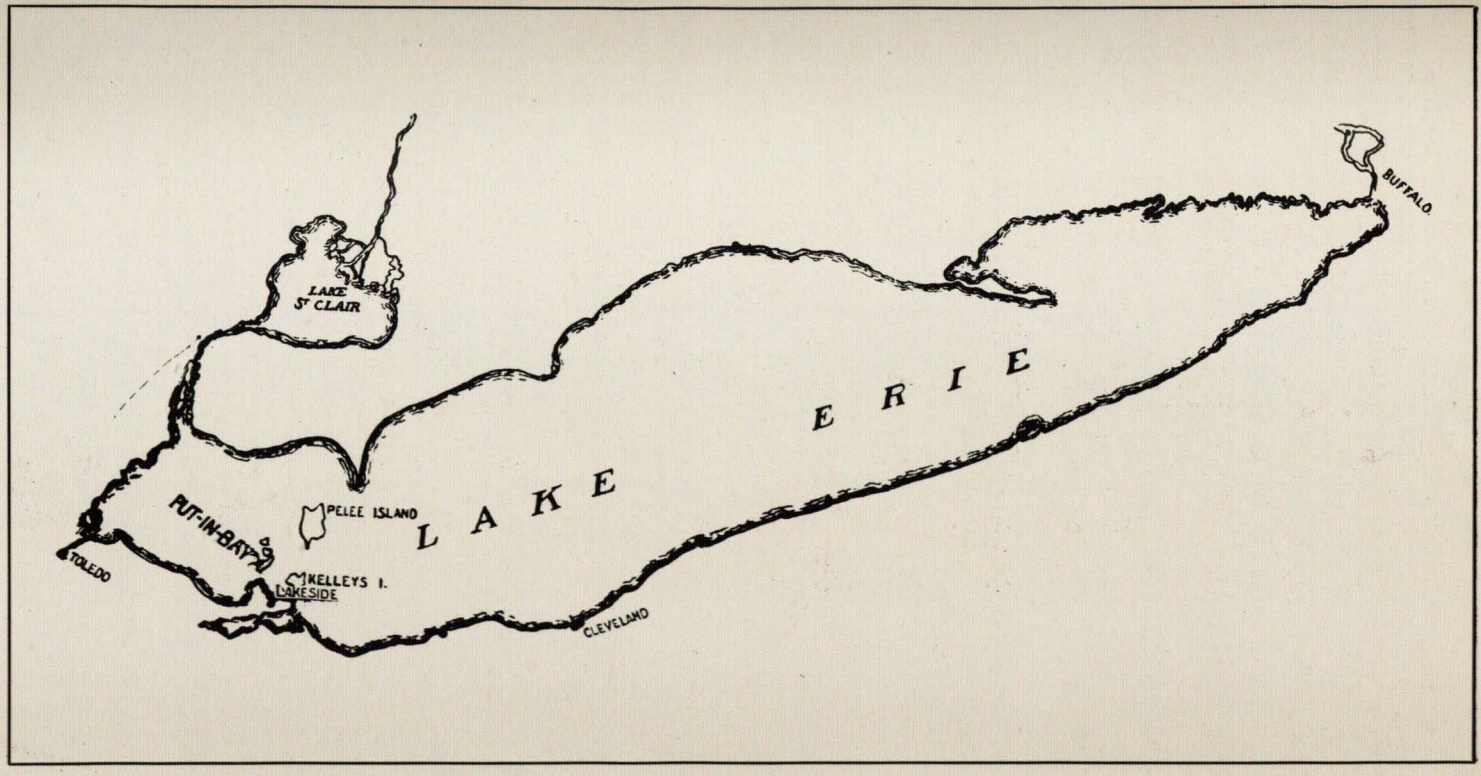
SECOND TERM

Monday—Wednesday—Friday Courses

Botany 664—Plant Ecology
Zoology 651—Advanced Limnology
Zoology 660—Physiology of Fishes
Entomology 671—Aquatic Entomology

Tuesday—Thursday—Saturday Courses

Botany 667—Physiology of AquaticPlants
Zoology 622—Advanced Invertebrates
Zoology 623—Fish Ecology and Management



Map of Lake Erie